Joint Studies for Flow Apportionment

POPLAR RIVER BASIN IN SASKATCHEWAN AND MONTANA

MAIN REPORT

Report of the International Souris-Red Rivers Engineering Board, Poplar River Task Force

FEBRUARY 1976

INTERNATIONAL SOURIS-RED RIVERS ENGINEERING BOARD

REGINA, SASKATCHEWAN, CANADA
WASHINGTON, D.C., UNITED STATES

International Joint Commission
Ottawa, Ontario, Canada
Washington, D.C, United States

February , 19

Gentlemen:

The International Souris-Red Rivers Engineering Board, through its Poplar River Task Force, has completed the investigation and study necessary to advise the Commission on matters which it must consider in making a report to the Governments of Canada and the United States regarding an apportionment of the waters of the Poplar River Basin.

Attached hereto is a copy of the report prepared by the Board's Task Force. The Main Report is entitled "Joint Studies For Flow Apportionment - Poplar River Basin in Saskatchewan and Montana", and there are three appendices. The investigations summarized therein reflect the efforts of several agencies in Canada and the United States. The suggested apportionment and procedure for administering an apportionment agreement are contained in Chapter VIII and summarized in Chapter I of the Main Report. The Main Report also summarizes the background investigations that are presented in detail in the three appendices.

The Board wishes to draw to your attention the excellent work of the Task Force, supported by the agencies from which staff members were drawn, in carrying out the necessary investigations and in preparing the attached report in a very limited time.

The Board concurs in the recommendations of its Task Force for apportionment of waters of the Poplar River Basin and for administration of that recommended apportionment.

The Board wishes to emphasize that the proposed apportionment formula defines a long-term solution to the sharing of the waters of the Poplar River between the United States and Canada, however it is felt that special arrangements are necessary for the filling period of the reservoir currently under construction on the East Poplar River by the Saskatchewan Power Corporation. Short term arrangements which would ensure early filling of the reservoir could hold advantages to both countries. With the reservoir filled to its operational level, Saskatchewan would be assured that the new power plant would be put "on stream" and Montana would be assured that regulated flows would be available during periods of need.

You will note from the report that the yield of the Poplar River varies markedly from year to year. The flows recorded in April and May of 1975, for example, would have filled the reservoir in weeks. On the other hand, a sequence of dry years would cause an extended filling period. Under average flow conditions the reservoir would take two years to fill to the safe operational capacity of 15,000 ac. ft. if the recommended apportionment formula were observed. Under the same conditions, the reservoir would fill to its full supply level of 32,000 ac. ft. in 4 to 5 years, assuming no power plant operation.

Saskatchewan and Montana are presently discussing interim arrangements for apportionment. Their discussions were initiated at a meeting between the United States Department of State and the Canadian Department of External Affairs on April 15, 1975.

If the apportionment formula recommended herein is adopted it would ultimately supersede the interim filling arrangements mentioned above. Therefore, it is recommended that the Commission discuss with Saskatchewan and Montana, the timing for transition from interim apportionment arrangements to final apportionment.

Although the question of water quality was not included in its Terms of Reference, the Board draws the Commission's attention to the fact that water quality was a consideration in forming the

[illegible]
on the [illegible]
Board [illegible]
water [illegible].

The Board want[illegible] matter.

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Regina, [illegible]

MAIN REPORT - Summary of [illegible]
regarding interstate [illegible]

APPENDIX A* - EXISTING AND HISTORICAL [illegible] WATER USE
Documentation of water use in the [illegible]
and criteria for determining these [illegible]

APPENDIX B* - NATURAL FLOWS
Tabulations of reconstructed natural flow [illegible]
points in the basin and methodology for [illegible]

APPENDIX C* - PROBABLE FUTURE WATER USE
Potential for future water use in the [illegible]
of location and quantity of possible future [illegible]

* Appendix [illegible] will be published [illegible]

POPLAR RIVER TASK FORCE

HELENA, MONTANA, UNITED STATES
REGINA, SASKATCHEWAN, CANADA

International Souris-Red Rivers Engineering Board
Washington, D.C., United States
Regina, Saskatchewan, Canada

February 6, 1976

Gentlemen:

The Poplar River Task Force, established by your Board in April, 1975, and in accordance with your terms of reference, has completed the investigations and studies necessary for you to advise the International Joint Commission on matters which it must consider in making a report to the two Governments regarding an international flow apportionment agreement between Canada and the United States for the Poplar River Basin. The findings, conclusions and recommendations of the Task Force, together with a suggested procedure for Poplar River flow apportionment, are included in the attached report with its three appendices.

The investigations herein summarized reflect the efforts of several agencies in Canada and the United States. The suggested division of Poplar River surface water, a method of computing this flow division, and procedures for administering an apportionment agreement are contained in Chapter VIII and summarized in Chapter I of the Main Report. The Main Report also summarizes the background investigations that are presented in detail in the three appendices.

The Task Force now considers its charge, as stated in the terms of reference, to be completed and awaits further direction from the Board.

Yours sincerely,

Denis A Davis

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Chairman, Canadian Section
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1 Attachment
Main Report and Appendices
(in four volumes)

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I. [illegible]

The Poplar River [illegible]

A. The aggregate natural [illegible] Poplar River Basin crossing the [illegible] equally between Canada and the United States [illegible] conditions:

1. The total natural flow of the [illegible] all its tributaries crossing the [illegible] shall be divided equally between [illegible] but the flow at the international [illegible] shall not be depleted by [illegible]

2. The total natural flow of all [illegible] in the Poplar River Basin [illegible] shall be divided equally between [illegible] Specific conditions of this division [illegible]

   a) Canada shall deliver to [illegible] percent of the natural flow [illegible] at the international boundary [illegible] fluence of Goose Creek [illegible]

   b) The delivery of water to [illegible] the last Poplar River [illegible] first day [illegible]

      i) The [illegible] River, [illegible] forms the [illegible] [illegible] [illegible]

cubic metres per second (1.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary throughout the succeeding 12 month period commencing June 1st. In addition a volume of 370 cubic decametres (300 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

ii) When the total natural flow of the Middle Fork Poplar River, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period is greater than 4,690 cubic decametres (3,800 acre-feet), but does not exceed 9,250 cubic decametres 7,500 acre-feet), then a continuous minimum flow of 0.057 cubic metres per second (2.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary during the succeeding period June 1st through August 31st. A minimum delivery of 0.028 cubic metres per second (1.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 617 cubic decametres (500 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

iii) When the total natural flow of the Middle Fork Poplar River, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period is greater than 9,250 cubic decametres (7,500 acre-feet), but does not exceed 14,800 cubic decametres (12,000 acre-feet), then a continuous minimum flow of 0.085 cubic metres per second (3.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary during the succeeding period June 1st through August 31st. A minimum delivery of 0.057 cubic metres per second

(2,[illegible] cubic feet per [illegible] from September [illegible] of the following year. In addition, [illegible] (500 acre-feet) will be [illegible] upon demand at any time during the [illegible] commencing June 1st.

iv) When the total natural flow [illegible] as determined below the confluence [illegible] the immediately preceding March 1st to May [illegible] exceeds 14,800 cubic decametres (12,000 acre-feet), a continuous minimum flow of [illegible] second (3.0 cubic feet per second) shall be [illegible] to the United States on the East Sullivan [illegible] international boundary during the [illegible] 1st through August 31st. A minimum flow of [illegible] cubic metres per second (2.0 cubic feet per second) shall then be maintained from September 1st through May [illegible] of the following year. In addition, [illegible] cubic decametres (1,000 acre-feet) will be made available to the United States upon demand at any time during the 12 month period commencing June 1st.

c) The natural flow at the international boundary in the remaining individual tributaries [illegible] by more than 60 percent of its natural flow.

3. The natural flow and division periods for [illegible] purposes shall be determined, unless otherwise [illegible], for periods of time commensurate with the [illegible] ments of both countries.

B. A Board of Control be established to [illegible] of waters and report on such matters that may be brought [illegible] of the International Joint Commission. The [illegible] of apportionment and methods of calculating [illegible]

Other Recommendations

Two important questions related to the matter of apportionment, but not specifically within the terms of reference, were brought to the attention of the Poplar River Task Force. These matters were concerned with interim apportionment during the filling period of the East Poplar Reservoir near Coronach and water quality.

The Poplar River Task Force unanimously recommends that consideration be given to the question of interim apportionment during the filling period of the East Poplar Reservoir near Coronach and that consideration of the water quality implications of the proposed apportionment be continued. Further discussion of these matters is found in Chapter IX.

II. [illegible]

Background

Problems related to limited water supplies in the [illegible] Basin in Montana and Saskatchewan have existed since [illegible] in the late 1880's. Although not as severely affected during the drought of the 1930's as were regions further west, the [illegible] hardships caused by water shortages during the 1930's.

The Coronach and Clarks' Bridge Reservoirs on the East Poplar River and the West Poplar River Reservoir in Saskatchewan are the major water storage facilities in the basin. A large number of small stockwatering ponds have been built in Montana and Saskatchewan.

Irrigation projects in the basin are usually limited to flood plain lands, with most of the projects in Montana concentrated along the Poplar River and its main tributaries. In Saskatchewan, irrigation projects are of relatively smaller scale, with the majority of projects located in the East Poplar River subbasin.

On February 21, 197[illegible], the Saskatchewan Power Corporation was authorized by the Saskatchewan Department of the Environment under the Provincial Water Rights Act to construct a dam to create a [illegible] decameter (82,000 acre-feet) reservoir on the East Poplar River [illegible] 3.7 kilometres (2 miles) upstream of the international boundary. The authorization included the use of East Poplar River water for developing the thermal power potential of the Utility's [illegible] to the west of the town of Coronach along Grand Creek. Since the East Poplar River is an international river, it is subject to the [illegible] Improvements Act of Canada. A licence to divert water from the East Poplar was issued to the Saskatchewan Power Corporation in 197[illegible] by Environment Canada subject to several terms and conditions, including the limitations resulting from future international water [illegible]

Poplar River Basin. Since this project will reduce downstream water supplies in Montana, the United States Government brought this concern to the Government of Canada on February 10, 1975.

It was recognized that Canada and the United States should each have the right to independently develop their water resources. In view of the very limited surface runoff in the basin, it is obvious that water related development has definite limits. Therefore, an apportionment agreement should consider the nature and magnitude of existing and future water demands in the basin and should be directed toward the efficient and beneficial use of Poplar River water for both countries.

The International Joint Commission, on April 8, 1975 under the reference dated January 12, 1948, instructed the International Souris-Red Rivers Engineering Board to proceed with investigations leading to recommendations on equitable apportionment of the waters of the Poplar River Basin.

Poplar River Task Force

To undertake and report on the Poplar River investigations, the International Souris-Red Rivers Engineering Board, with the approval of the Commission, appointed an international Poplar River Task Force.

Terms of Reference

The Poplar River Task Force was asked to make recommendations on:

1. An equitable apportionment at the international boundary of the flows of the Poplar River Basin,

2. A method of calculation of natural flows in the Poplar River Basin at the international boundary, and

3. The membership and terms of reference for an international group to administer an apportionment agreement.

Studies were to consider water use and flow on all main branches and tributaries of the Poplar River and to arrive at an equitable division

of flow at the inter[illegible] [illegible]
across the international [illegible]
and therefore specific to [illegible]
Canada and cross, or contribute to [illegible]
boundary into the United States.

The following steps were [illegible]

a. Evaluate historical and [illegible] in the watershed.

b. Reconstruct sequences of natural flow [illegible] would have occurred without the effect [illegible] the flow regime.

c. Identify probable future water use in the [illegible]

d. Evaluate various apportionment alternatives [illegible] identify the most desirable and mutually [illegible] to the division of waters of the Poplar River [illegible] national boundary.

e. Develop a method of calculating natural [illegible] national boundary to facilitate administration [illegible] ment.

f. Define membership and term of reference [illegible] administration of an apportionment agreement.

Membership

The members of the Task Force were drawn [illegible] ments of Canada, United States, Montana and [illegible] represented by the members of the Task Force [illegible] were responsible for carrying out the specific [illegible] ment study.

Table 1: Membership and Government Affiliation, Poplar River Task Force, 1975-76.

Task Force

Bill Christiansen, Lieutenant-Governor, State of Montana
D. A. Davis, Environment Canada (Chairman, Canadian Section)
R. B. Godwin, Canada Department of Regional Economic Expansion
R. L. McPhail, U.S. Bureau of Reclamation
G. C. Mitchell, Saskatchewan Department of the Environment
G. M. Pike, U.S. Geological Survey (Chairman, United States Section)

Secretaries

J. M. Dooley, U.S. Bureau of Reclamation
T. K. Olson, Saskatchewan Department of the Environment

Task Force Alternates[*]

D. R. Cuthbert, Environment Canada
J. M. Dooley, U.S. Bureau of Reclamation
O. A. Ferris, Montana Department of Resources and Conservation
C. O. Geiger, U.S. Geological Survey
J. R. Hart, Saskatchewan Department of the Environment

[*] Other study contributors are acknowledged in appropriate appendices

[illegible]

The Poplar River, a tri[illegible] [illegible] southern Saskatchewan to northeastern [illegible] of 8,622 square kilometres (3,329 sq.mi.). Approx[illegible] basin, or 3,149 square kilometres (1,21[illegible] q.mi.), i[illegible] the remaining 5,473 square kilometres (2,113 sq.mi.[illegible] (Figure 2).

Physical features

The drainage area of the Poplar River is [illegible] pear with its major tributaries rising from the south[illegible] Mountain and areas to the east of Wood Mountain in Saskatchewan. The area narrows from a maximum width of about 100 kilometres [illegible] the international boundary to the river's mouth near [illegible], Montana, a distance of some 115 kilometres (70 miles). The Poplar has [illegible] branches, each of which originates in Canada. The East Poplar River has a basin area of 1,205 square kilometres (749 sq.mi.) [illegible] Poplar River (937 sq.km. or 582 sq.mi.), the Canadian [illegible] called the Poplar River, to form the main stem about [illegible] (2 miles) north of Scobey in Montana. The [illegible] (2,615 sq.mi.), known as the West Poplar River [illegible] main stem roughly midway between Scobey and [illegible], Montana. The East Poplar headwaters drain into Brush Lake [illegible] this natural lake occurs about once in ten years, [illegible] eliminates approximately 61 square kilometres [illegible] area of the East Poplar [illegible] for all tributaries [illegible] Poplar [illegible] Table 6-1.

The topography of the Poplar River Basin is level to gently rolling, with soils ranging from sandy and clay loam over glacial till in the uplands to more fertile alluvium in the river valleys. The lower portion of the Middle Fork and the main stem of the Poplar below Scobey pass through valleys varying in width from two to four miles. Other tributary streams including the West Fork and East Poplar are located in smaller and narrow valleys. Due to the semi-arid climate of this region (mean annual precipitation of 30 to 40 centimetres or 12 to 16 inches) these river valleys and the surrounding prairie have developed as natural grasslands.

Social and Economic Features

Approximately seven to eight thousand people live in the Poplar River Basin, of which roughly two-thirds are United States' citizens. Settlement in the basin is predominantly rural with several small urban service centres. The largest of these centres are Rockglen (population 524) and Coronach (300) in Saskatchewan, and Poplar (1,400) and Scobey (1,500) in Montana. The Fort Peck Indian Reservation, residence of the Sioux and Assiniboine Tribes in Montana, encompasses about 1,450 square kilometres (900 sq.mi.) of the watershed, representing the lower third of the basin. Agricultural practices dominate the economy of the region with cereal crops, fodder crops and ranching the main interests.

Due to the technical nature of this investigation, public meetings and attitude surveys did not form a part of the study. However the study group was aware of a concern on the part of basin residents over the lack of water in the basin. Concerns of this nature were expressed by representatives of the Fort Peck Indian Tribes at several meetings of the Task Force. The Tribes have tentative plans for a major irrigation program in the watershed (Appendix C) which could utilize a large portion of the flows of the Poplar River.

Surface Water Features

The long term average annual discharge of the Poplar River near its [illegible] cubic metres per second (133 cubic feet per second), but flows [illegible] seasonal basis and from year to year. For example, in

[illegible] years of record [illegible]
mean annual flow [illegible]
[illegible] in 1934. [illegible]
[illegible] periods of no [illegible]
[illegible] exceeded 1050 [illegible]
April or May from runoff [illegible]
fall. The peak rapidly [illegible]
Poplar in the range of [illegible]

The long term average annual, [illegible]
natural discharges of the Poplar River and it [illegible]
by available recorded and synthesized runoff [illegible]
It is apparent from the average annual yield [illegible]
water tributaries of the Middle Poplar River [illegible]
atchewan contribute significantly to streamflow [illegible]
of low or zero flow occur in the Poplar River [illegible]
in the fall and winter months.

It is difficult to make adequate [illegible]
of water in the Poplar River or its tributaries [illegible]
in which water quality has been monitored [illegible]
in December, 1973).

Available data indicates that water [illegible]
critical during summer low-flow periods, [illegible]
depleted during winter ice cover periods. [illegible]
or detract from existing uses of Poplar River water [illegible]
sodium, sulfate and total dissolved [illegible]
oxygen and pH. Increased [illegible]
and aquatic production. During [illegible]
River ranged from [illegible]
these concentrations of iron and other [illegible]
than normal because [illegible]
[illegible] in 20 years.

Table 2 Long Term Average Annual, Minimum Annual and Maximum Annual Natural Flows of the Poplar River and Related Yields per Unit Area

Location	Area	Average Annual Flow	Average Annual Yield	Minimum Annual Flow	Minimum Annual Yield	Maximum Annual Flow	Maximum Annual Yield
	sq.km (sq.mi.)	dam^3 (ac-ft)	dam^3/km^2 (ac-ft/mi^2)	dam^3 (ac-ft)	dam^3/km^2 (ac-ft/mi^2)	dam^3 (ac-ft)	dam^3/km^2 (ac-ft/mi^2)
West Fork Poplar R. at int'l bdry.	376.6 (145.4)	4,686 (3,799)	12.4 (26.1)	142 (115)	0.4 (0.8)	24,991 (20,260)	66.4 (139.3)
West Fork Poplar R. near Four Buttes	2,615.9 (1,010.0)	30,152 (24,444)	11.5 (24.2)	5,843 (4,737)	2.2 (4.7)	112,510 (91,212)	43.0 (90.3)
Middle Fork Poplar R. at int'l bdry.	927.2 (358.0)	15,987 (12,961)	17.2 (36.2)	2,890 (2,343)	3.1 (6.5)	54,210 (43,948)	58.5 (122.8)
Middle Fork Poplar R. near Scobey	1,506.3 (581.6)	26,376 (21,383)	17.5 (36.8)	4,618 (3,744)	3.1 (6.4)	89,247 (72,353)	59.3 (124.4)
East Poplar R. at int'l bdry.	737.1 * (284.6)*	15,388 (12,475)	20.9 (43.8)	3,260 (2,643)	4.4 (9.3)	57,717 (46,791)	78.3 ** (164.4)**
East Poplar R. near Scobey	1,247.3 * (481.6)*	23,652 (19,175)	19.0 (39.8)	4,474 (3,627)	3.6 (7.5)	83,007 (67,294)	66.6 ** (139.7)**
Poplar R. near Poplar	7,489.2 * (2,891.6)*	114,169 (92,560)	15.2 (32.0)	17,777 (14,412)	2.4 (5.0)	410,678 (332,937)	54.8 ** (115.1)**

*Excluding gross drainage area of Fife Lake which does not contribute to East Poplar flows in most years.

**Overflow from Fife Lake may cause these figures to be slightly high relative to maximum annual yields on other tributaries.

At the present time water quality appears to be seasonally acceptable or marginally acceptable for agriculture use due to high concentrations of boron and total dissolved solids. Temperature, dissolved oxygen and total dissolved solids approach critical limits for aquatic uses. Further deterioration of water quality could seriously impair existing or future uses in the basin.

IV. [illegible]

The pla[illegible] tudy [illegible] and historical surface water use, [illegible] of probable future water use in the Poplar River [illegible] of flow apportionment alternatives. Most [illegible] had to be gathered by field and basin resident [illegible] the United States. The study effort and expenditure [illegible] toward the report were shared roughly equally by the [illegible] of the State of Montana and the Province of [illegible] cant role in this effort.

Existing and Historical Surface Water [illegible]

To provide information on which [illegible] flow and decisions regarding division of flow, it was [illegible] existing and historical water use in the basin. The [illegible] inventory was based on 1975 levels of surface water [illegible] historical uses inventory encompassed the period 19[illegible]

A statement on the legal aspects of water [illegible] and the United States, with special emphasis [illegible] was included in Appendix V.

Water rights permits and records were [illegible] to provide a reliable data base [illegible] and/or verify documentation of the [illegible] ive field investigations were carried out. [illegible] to identify locations and [illegible] of surface water [illegible] basin residents were interviewed [illegible] levels of water use. These studies [illegible]

Natural Flow

To fully assess the quantity of surface water that is available in the Poplar River Basin, natural flows adjusted for consumptive uses were reconstructed or synthesized at six locations (see Appendix B). These key points where some historical streamflow records are available are listed below:

1. West Fork Poplar River at international boundary
2. Middle Fork Poplar River at international boundary
3. East Poplar River at international boundary
4. East Poplar River near Scobey, Montana
5. Middle Fork Poplar River near Scobey, Montana
6. Poplar River near Poplar, Montana

Streamflow data in the form of monthly mean flows at these sites were adjusted by adding the effect of upstream water use to represent natural flow conditions. These flow sequences were then extended as necessary by statistical methods to the base period of 1931 to 1974.

To provide additional information on the flow regime of the watershed, natural flows were mathematically reconstructed or synthesized for the 1931 to 1974 period at the following locations:

1. Coal Creek at international boundary
2. Coal Creek near Four Buttes, Montana (Mouth of Creek)
3. East Tributary of West Fork Poplar River at international boundary
4. Cow Creek at international boundary
5. West Fork Poplar River near Four Buttes, Montana
6. Poplar River near Kahla, Montana

These data were further supplemented and/or supported by data from stream gauges that were re-established or newly installed during the late spring of 1975 at the following locations:

1. West Fork Poplar River at international boundary
2. East Poplar River at Coronach Dam Site
3. Cow Creek near international boundary

4. East [illegible]
5. Midd[illegible]
6. Poplar [illegible]r, [illegible]

Probable [illegible]uture

[illegible]e provide an insight int[illegible] in assessment of firm plans, permits, [illegible]nd Saskatchewan during the period 1976 through 19[illegible] presently identified future uses beyond 198[illegible] concerning probable future water use in the Fort Pe[illegible] provided by the Fort Peck Tribal Council thr[illegible] sulting engineers. Results of the sector study are [illegible]

Assessment of Flow Apportionment Alter[illegible]

A method of assessing alternative flow app[illegible] developed to assist in evaluating their potential effe[illegible] in the Poplar River Basin. The mathematical [illegible] basin was used to define the effect of the various [illegible] natives on monthly mean flow at the synthesized [illegible]

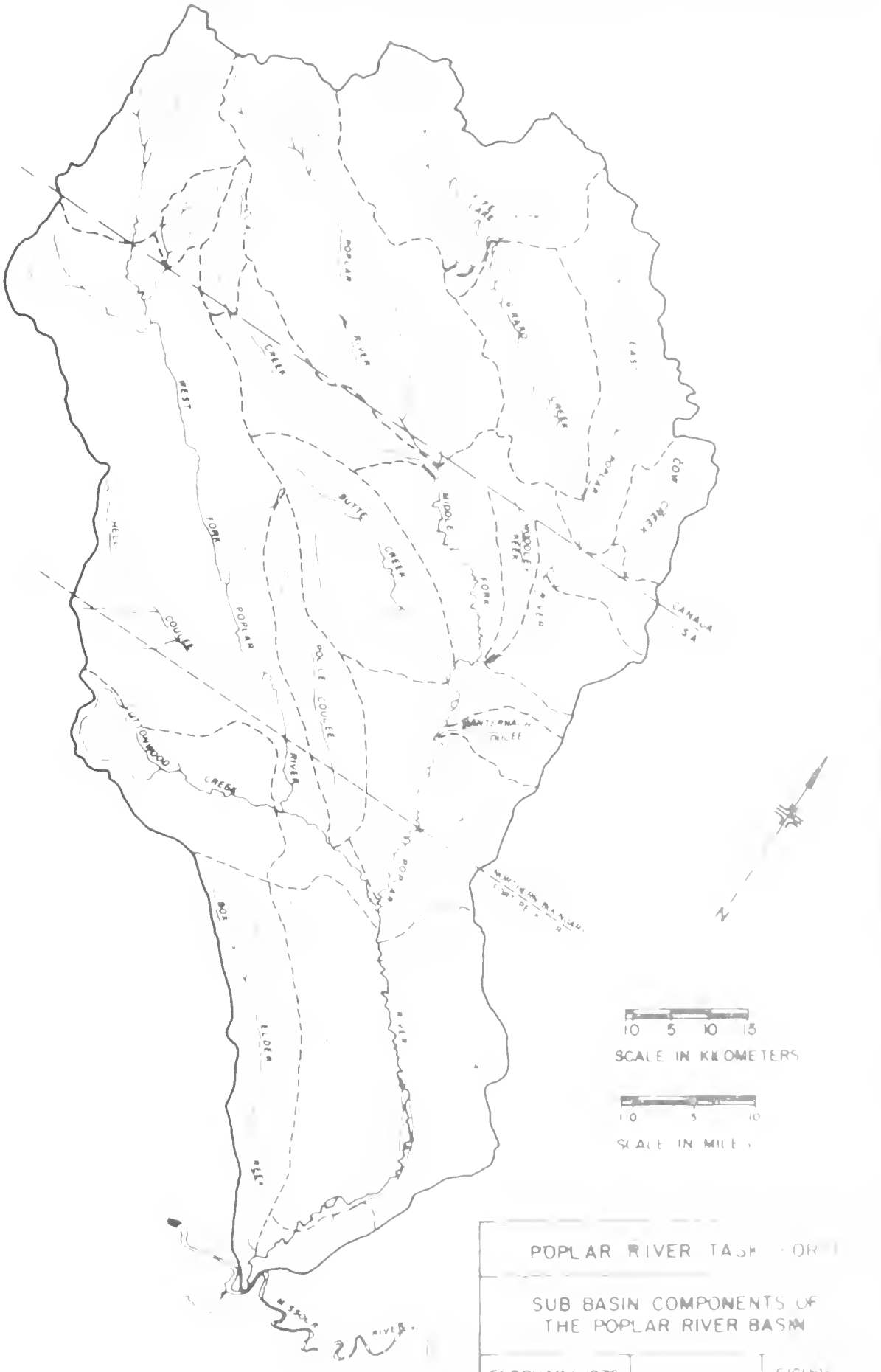
V. EXISTING AND HISTORICAL SURFACE WATER USE

Existing and historical surface water uses in the Poplar River Basin were estimated and documented based on 1975 and 1931 to 1974 levels of water use. The average annual uses at 1975 or existing levels of development in the Montana and Saskatchewan portions of the basin are estimated to be 10,720 cubic decametres (8,690 acre-feet) and 1,920 cubic decametres (1,560 acre-feet) respectively, for a total of 12,640 cubic decametres (10,250 acre-feet). The historical (1931 to 1974) annual uses in Montana have varied from a minimum of 1,979 cubic decametres (1,604 acre-feet) in the year 1934 to a maximum of 10,596 cubic decametres (8,590 acre-feet) in 1972. In Saskatchewan, the corresponding use estimates are 11 cubic decametres (nine acre-feet) in 1932 and 1933, and 4,675 cubic decametres (3,790 acre-feet) in 1958. This water use data accounts for irrigation, stockwatering, municipal, domestic and industrial uses. The existing use estimates incorporate surface evaporation rates in reservoirs for an average year. A detailed description of the investigation procedures, criteria and assumptions on which the information in this chapter is based is presented in Appendix A.

A total of 897 projects were identified in the Poplar River Basin during this study. The types of projects identified, and their locations by subbasin (Figure 1) are summarized in Table 3.

Existing Surface Water Use

The quantity of surface water used in the Poplar River Basin for stockwatering and irrigation varies annually and is dependent upon the number of projects in operation. Conditions that dictate the operation or non-operation of a project, as well as the quantity of water use, include [illegible], seasonal precipitation, antecedent soil moisture content, [illegible] evaporation, water quality and the availability of water in the rivers.


POPLAR
RIVER
WEST
FORK
POPLAR
RIVER
BUTTE
CREEK
MIDDLE
FORK
POPLAR
RIVER
EAST
FORK
POPLAR
RIVER
COW
CREEK
CANADA
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POPLAR
COULEE
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SCALE IN KILOMETERS
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SCALE IN MILES
POPLAR RIVER TASK FORCE
SUB BASIN COMPONENTS OF
THE POPLAR RIVER BASIN
FEBRUARY 1976
FIGURE

Table 3: Number and Type of Water Use Projects in the Poplar River Basin

	Number of Projects			
	Domestic	Irrigation	Municipal	Total
Sub-basin (Saskatchewan)				
1. Cow Creek	10	2	0	12
2. East Poplar River	43	11	0	54
3. Girard Creek	20	7	1	28
4. Fife Lake	48	11	0	59
5. Poplar River	38	3	0	41
6. Coal Creek	2	0	0	2
7. East Tributary of West Poplar River	6	2	0	8
8. West Poplar River	14	3	0	17
9. Other Canadian Tributaries	3	1	0	4
Sub-Total - Saskatchewan	184	40	1	225
Sub-basin (Montana)				
International Boundary to Fort Peck Indian Reservation Boundary				
10. Cow Creek	3	0	0	3
11. East Poplar River	22	7	0	29
12. Woodley Creek	8	3	0	11
13. Middle Fork Poplar River	11	6	0	17
14. Coal Creek	33	1	0	34
15. West Fork Poplar River	158	5	0	163
16. Poplar River Main Stem	34	12	1	47
17. Butte Creek	46	3	0	49
18. Manternach Coulee	5	4	0	9
19. Police Coulee	(in W. Fork)	3	0	3
Sub-Total	320	44	1	365
Fort Peck Indian Reservation to Mouth				
20. Poplar River to West Fork	24	3	0	27
21. West Fork Poplar	33	2	0	35
22. Cottonwood Creek	40	0	0	40
23. Police Creek	3	1	0	4
24. Poplar River, West Fork to USGS Gauge 6-1810	135	9	0	144
25. Poplar River, USGS Gauge 6-1810 to Missouri River	7	2	0	9
26. Box Elder Creek	48	0	0	48
Sub-Total	290	17	0	307
TOTAL - POPLAR RIVER BASIN	794	101	2	897

Of the [illegible] feet) for the existing [illegible] requirements account for [illegible] The balance is accounted for [illegible] municipal uses. Domestic water [illegible] as surface evaporation from the [illegible] the basin. The crops in the [illegible] alfalfa, native hay and alfalfa-[illegible] for livestock. Coronach, Saskatchewan and [illegible], Montana obtain [illegible] wells adjacent to Girard Creek and the main [illegible] accounting for all of the municipal use. Water [illegible] dustrial purposes in the watershed, although several [illegible] in this classification are proposed for the future [illegible].

Surface water use in the 26 subbasins [illegible] Watershed for the 1975 level of development are [illegible].

Historical Surface Water Use

Historical water use in the Poplar River [illegible], as expected, increased significantly from the [illegible] cubic decametres (1,807 acre-feet) in 1931. The [illegible] ical use of 10,596 cubic decametres (8,590 acre-feet) [illegible] trend of increased beef cattle production [illegible] feed crops, which require one decree of irrigation [illegible], surface water use for irrigation and domestic use [illegible] a continuous upward trend from 1931 to 1974. The [illegible] cubic decametres (3,790 acre-feet) in 1948, [illegible] use in subsequent years does not [illegible] surface evaporation from large reservoirs [illegible] estimates. A decrease in surface evaporation [illegible] (Appendix A, Table 5 [illegible]) is [illegible] reservoir storage [illegible] unit use.

Table 4a: Existing (1975 Level) Surface Water Use in the Poplar River Basin (Cubic Decametres)

	Domestic Use	Domestic Evap.	Irrigation Use	Irrigation Evap.	Municipal	Mean Evap. on Large Reservoirs	Total
Sub-basin (Saskatchewan)							
1. Cow Creek	10	17	0	0	0	0	27
2. East Poplar River	30	100	75	0	0	185	390
3. Girard Creek	25	136	49	55	44	296	606
4. Fife Lake	63	84	79	15	0	0*	240
5. Poplar River	59	96	64	0	0	0	220
6. Coal Creek	6	6	0	0	0	0	12
7. East Tributary of West Poplar River	10	2	16	0	0	0	28
8. West Poplar River	20	25	15	0	0	284	343
9. Other Canadian Tributaries	2	30	25	0	0	0	57
Sub-Total - Saskatchewan	224	496	323	70	44	765	1923
Sub-basin (Montana)							
International Boundary to Fort Peck Indian Reservation Boundary							
10. Cow Creek	11	5	0	0	-		16
11. East Poplar River	32	51	667	0	-		750
12. Woodley Creek	11	14	465	0	-		490
13. Middle Fork Poplar River	48	21	2405	0	-		2474
14. Coal Creek	37	33	32	0	-		102
15. West Fork Poplar River	244	192	954	0	-		1390
16. Poplar River Main Stem	69	75	1849	432	-		2425
17. Butte Creek	69	149	202	0	-		420
18. Manternach Coulee	11	17	384	0	-		412
19. Police Coulee	(in W. Fork Total)		194	0	-		194
Sub-Total	532	557	7152	432	-		8673
Fort Peck Indian Reservation to Mouth							
20. Poplar River to West Fork	21	46	522	0	-		589
21. West Fork Poplar	48	61	48	0	-		157
22. Cottonwood Creek	63	76	0	0	-		139
23. Police Creek	6	10	31	0	-		47
24. Poplar River, West Fork to to USGS Gauge 6-1810	153	412	246	0	-		811
25. Poplar River, USGS Gauge 6-1810 to Missouri River	10	7	102	0	-		119
26. Box Elder Creek	57	128	0	0	-		185
Sub Total	358	740	949	0	-		2047
TOTAL - POPLAR RIVER BASIN	1114	1793	8494	476	765		12643

*Existing uses in the Fife Lake basin have offset the effect of the control on Fife Lake and the lake has been close to its natural level in recent years.

Table 4b [illegible]

	Domestic Use	Evap	Irrigation Use	Evap	[illegible]	[illegible]	[illegible]
Sub-basin (Saskatchewan)							
1. Cow Creek	8	14	0	0	[illegible]	[illegible]	[illegible]
2. East Poplar River	24	81	61	0	[illegible]	[illegible]	[illegible]
3. Girard Creek	20	110	40	[illegible]	36	[illegible]	[illegible]
4. Fife Lake	51	68	64	12	[illegible]	[illegible]*	[illegible]
5. Poplar River	48	78	52	0	0	[illegible]	[illegible]
6. Coal Creek	5	5	0	0	[illegible]	[illegible]	[illegible]
7. East Tributary of West Poplar River	3	2	13	0	[illegible]	[illegible]	[illegible]
8. West Poplar River	16	20	12	[illegible]	[illegible]	[illegible]	[illegible]
9. Other Canadian Tributaries	2	24	20	0	0	[illegible]	[illegible]
Sub-Total - Saskatchewan	182	402	262	[illegible]	36	[illegible]	[illegible]
Sub-basin (Montana)							
International Boundary to Fort Peck Indian Reservation Boundary							
10. Cow Creek	9	4	0	0	[illegible]	[illegible]	[illegible]
11. East Poplar River	26	41	541	0	[illegible]	[illegible]	[illegible]
12. Woodley Creek	9	11	377	0	[illegible]	[illegible]	[illegible]
13. Middle Fork Poplar River	39	17	1950	0	[illegible]	[illegible]	[illegible]
14. Coal Creek	30	27	26	0	[illegible]	[illegible]	[illegible]
15. West Fork Poplar River	198	156	773	0	[illegible]	[illegible]	[illegible]
16. Poplar River Main Stem	56	61	1499	350	[illegible]	[illegible]	[illegible]
17. Butte Creek	56	121	164	0	[illegible]	[illegible]	[illegible]
18. Manternach Coulee	9	14	311	0	[illegible]	[illegible]	[illegible]
19. Police Coulee	(in W. Fork Total)		157	[illegible]			
Sub Total	432	452	[illegible]	350			
Fort Peck Indian Reservation to Mouth							
20. Poplar River to West Fork	17	37	423	[illegible]			
21. West Fork Poplar	39	59	89	[illegible]			
22. Cottonwood Creek	51	62	0	[illegible]			
23. Police Creek	5	8	25	[illegible]			
24. Poplar River, West Fork to to USGS Gauge @ 1810	124	334	197	[illegible]			
25. Poplar River, USGS Gauge @ 1810 to Missouri River	8	6	53	[illegible]			
26. Box Elder Creek	46	104	0	[illegible]			
Sub Total	290	610	769				
TOTAL POPLAR RIVER BASIN	904	1464	6952	350	[illegible]	[illegible]	[illegible]

* Existing uses in the Fife Lake basin [illegible] the Lake has been closed to its natural [illegible]

Data for total historical water use in the 26 subbasin components of the Poplar River Basin for the period 1931 to 1974 are listed in Table 5. A more detailed breakdown of these total uses into domestic, irrigation, large reservoir evaporation and municipal uses is presented in Appendix A.

Water Rights

Concern for the protection of reserved water rights of the Fort Peck Tribes was brought to the attention of the Task Force. In Appendix A, the Task Force noted that legal questions do exist relating to water rights and permits in both Canada and the United States. The Task Force views these legal questions, including protection of United States Federal reserved water rights, as internal matters to be resolved within the respective countries. The discussion in Appendix A includes mention of water law in Canada, United States Federal reserved water rights, and Montana State water law.

Table

Year				
	cubic decametre			
1931	14	11		
1932	11	9		
1933	11	9		
1934	17	14		
1935	49	40		
1936	58	4		
1937	148	120		
1938	160	130		
1939	271	220		
1940	247	200		
1941	247	200	3,271	
1942	210	170	3,332	
1943	296	240		
1944	247	200		
1945	247	200		
1946	247	200		1,91
1947	234	190		
1948	592	480		
1949	678	550		2,4
1950	481	390		
1951	771	630	3,314	2,687
1952	3,281	2,660		
1953	1,875	1,520		
1954	1,813	1,470		
1955	3,195	2,590		
1956	3,738	3,030		
1957	3,491	2,830		
1958	4,675			
1959	3,343	2,710		
1960	3,096			
1961	4,342			
1962	2,319			
1963	2,196			
1964	3,182			
1965	2,023			
1966	2,294			
1967	1,875			
1968	2,072			
1969	1,887			
1970	1,863			
1971	2,368			
1972	2,060			
1973	1,912			
1974				

VI. NATURAL FLOWS

Natural streamflow data represents the flow that would have occurred in rivers and streams without the influence of man on the flow regime. Natural streamflows at selected locations in the Poplar River Basin were estimated to assess the amount of water available for use in the watershed, and to provide a data base which could be used to evaluate the impacts of alternative apportionment schemes on existing and future water use in the basin. In addition, the administration of any future water apportionment agreement will entail natural flow computations at the international boundary crossings on some or all of the major branches of the Poplar.

Natural streamflow data in the basin were estimated on a monthly mean basis. The definition of natural flows for time periods shorter than one month could not be justified for the purposes required in the study, and more detailed historical water use information is not available.

Natural Flow Study Points

Natural flows were estimated at 12 locations in the basin. Six international boundary locations were selected to provide information on natural flows rising in the Canadian portion of the basin. Natural flows were identified at the remaining downstream locations in Montana to provide a basis for evaluating the effect of flow apportionment alternatives on water availability in Montana. These natural flow study points are listed below:

International Boundary Sites

1. West Fork Poplar River at international boundary
2. Middle Fork Poplar River at international boundary
3. East Poplar River at international boundary
4. Coal Creek at international boundary
5. Cow Creek at international boundary
6. East tributary of West Fork Poplar River at international boundary

Montana [illegible]

1. East Poplar [illegible]
2. Middle Fork [illegible]
3. Poplar River [illegible]
4. Coal Creek near [illegible]
5. West Fork Poplar [illegible]
6. Poplar River near [illegible]

Computation [illegible]

For the six locations where [illegible] available, natural mean monthly stream [illegible] defined as follows:

1. Natural flows for the period of [illegible] adding the estimated historical [illegible] recorded flows in the months [illegible] to occur.

2. When streamflow records were [illegible] natural flows were estimated [illegible] equations. Natural flows [illegible] similar flows at several [illegible] stations. The best [illegible] to fill in missing monthly [illegible].

3. Where recorded winter [illegible] February) were not [illegible] based on technical criteria [illegible] on the site [illegible] flows were [illegible]

4. At locations where [illegible] water in [illegible] reservoirs, [illegible] were broadly calculated [illegible]

[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]

Estimates of natural flow at the six locations where recorded streamflow data are not available were based on natural flows defined at nearby Poplar River sites which have stream gauge data. In general, these natural flow estimates were determined using ratios of effective drainage areas at the gauged and ungauged sites. Where necessary, adjustments were made in the winter flows to more accurately reflect natural flow conditions to the smaller tributaries.

Results

Annual natural flows at the 12 selected locations in the Poplar River Basin are listed in Table 6 for the 1931 to 1974 study period. Estimates of natural monthly mean flows at these locations are tabulated in Appendix B.

The total annual flow of the Poplar River Basin at the international boundary averages 42,000 cubic decametres (34,000 acre-feet). The maximum annual flow is 160,000 cubic decametres (130,000 acre-feet) and the minimum annual flow is 6,950 cubic decametres (5,600 acre-feet). Some 85% of the flow at the boundary is measured in the three main tributaries; 36% in the East Poplar River, 38% in the Middle Fork Poplar River and 11% in the West Fork Poplar River.

The Middle and West Forks are more variable than the East Poplar, tending to have high spring and low to zero flows in late summer and fall. The East Poplar, on the other hand, usually maintains some base flow for most months of the year. A similar pattern is repeated at downstream stations. Even at Poplar River near Poplar, the late fall and winter flows frequently fall below 0.14 cubic metres per second (5 cfs).

Table 6a: Annual Natural Fl[illegible] in the Poplar River [illegible]

YEAR	LOCATION: West Fork Poplar R at Tor'l Bdry	*East Tributary West Poplar at Tor'l Bdry	* West Fork Poplar R near Four Buttes, Mont	* Coal Creek at Tor'l Bdry	* Coal Creek near Four Buttes, Mont	Middle Fk Poplar R at Tor'l Bdry	*Middle Fk Poplar R near [illegible]	East Fk Poplar R at Tor'l Bdry	* [illegible] at Tor'l Bdry	East [illegible]	* [illegible] at Tor'l Bdry	[illegible]
1931	303	56	7,270	54	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1932	755	138	10,400	164	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1933	2,350	424	18,700	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1934	2,920	531	34,100	571	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1935	370	67	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1936	2,030	371	13,700	338	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1937	257	46	5,960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1938	3,600	660	23,800	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1939	11,800	2,160	[illegible]	[illegible]	[illegible]	27,100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1940	1,570	287	12,200	107	2,670	8,180	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1941	2,020	368	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1942	1,540	279	12,600	299	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1943	7,110	1,310	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1944	1,090	201	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1945	2,960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1946	2,290	419	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1947	1,390	254	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1948	4,660	856	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1949	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1950	11,300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1951	7,140	1,310	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1952	25,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1953	3,460	629	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1954	18,400	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1955	10,600	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1956	3,000	548	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1957	724	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1958	3,530	645	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1959	1,180	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1960	5,320	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1961	142	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1962	3,830	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1963	6,730	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1964	1,200	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1965	1,673	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1966	2,239	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1967	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1968	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1969	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1970	5,160	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1971	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1972	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1973	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Minimum	142	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Maximum	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mean	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* Bracketed [illegible] for [illegible] complete period of record

Table 6b: Annual Natural Flows in Acre Feet at Selected Location in the Poplar River Basin

YEAR	West Fork Poplar R at Int'l Bdry.	*East Tributary, West Poplar at Int'l Bdry	*West Fork Poplar R near Four Buttes, Mont	*Coal Creek at Int'l Bdry	*Coal Creek near Four Buttes, Mont	Middle Fork Poplar R. at Int'l Bdry.	*Middle Fork Poplar R. near Scobey, Mont.	East Poplar R. at Int'l Bdry.	Cow Creek at Int'l Bdry.	East Poplar R. near Scobey, Mont.	*Poplar River near Wahla, Mont.	Poplar River near Poplar, Mont.
1931	246	45	6,300	48	686	2,340	3,740	2,640	82	3,630	6,930	14,400
1932	612	112	8,440	120	1,600	5,200	8,290	7,860	957	9,010	15,300	31,400
1933	1,900	344	15,200	369	3,040	9,320	15,000	5,710	625	8,890	25,000	50,200
1934	2,360	432	27,600	463	2,630	8,050	12,900	3,030	194	4,400	22,200	45,500
1935	300	54	6,190	58	1,660	5,540	9,140	5,360	629	8,870	20,600	42,700
1936	1,650	301	11,100	323	2,740	8,360	13,600	4,540	491	7,050	19,300	38,500
1937	208	37	4,740	40	826	2,680	4,350	2,860	134	7,150	21,100	42,200
1938	2,920	535	19,300	573	3,660	10,800	17,500	11,300	1,580	17,300	47,500	94,200
1939	9,580	1,760	57,100	1,880	8,200	22,000	36,500	16,500	2,540	19,400	74,700	147,000
1940	1,270	232	9,850	249	2,160	6,630	10,900	6,850	797	10,900	32,400	64,000
1941	1,640	298	9,380	319	3,310	10,300	16,700	9,950	1,310	15,900	25,300	50,000
1942	1,250	226	10,200	242	2,280	7,140	11,700	11,200	1,480	17,900	25,400	50,200
1943	6,760	1,220	54,900	1,310	10,500	32,000	51,300	25,200	3,960	41,700	112,000	221,000
1944	887	163	9,720	174	14,300	5,590	9,200	3,180	281	4,630	21,500	42,600
1945	2,400	440	20,400	471	2,550	7,170	11,900	5,340	539	8,230	32,300	63,500
1946	1,860	340	9,040	364	1,940	5,440	12,100	8,140	1,060	13,000	52,600	104,000
1947	1,120	206	15,200	220	3,540	11,600	18,500	18,700	2,860	30,800	38,900	76,100
1948	3,780	692	23,900	741	12,400	15,600	25,400	22,800	3,450	37,200	60,100	117,000
1949	391	70	6,230	75	1,520	4,910	8,010	8,060	1,040	12,800	21,100	41,000
1950	9,200	1,690	47,000	1,810	7,020	18,100	30,300	17,400	2,600	28,500	60,700	119,000
1951	5,790	1,060	33,900	1,140	3,940	9,900	16,800	10,900	1,060	16,400	45,500	88,300
1952	20,300	3,720	91,200	3,980	16,600	43,900	72,400	46,800	5,020	67,300	177,000	331,000
1953	2,800	510	24,100	547	5,420	17,100	27,500	8,460	1,020	13,200	40,500	79,200
1954	14,900	2,720	72,600	2,920	13,500	37,100	60,400	30,300	3,450	44,800	160,000	309,000
1955	8,580	1,570	47,700	1,690	10,100	29,200	47,400	37,800	5,260	43,300	90,100	175,000
1956	2,430	444	18,500	476	2,880	8,250	13,900	6,400	736	9,890	19,700	38,500
1957	587	106	8,590	113	1,260	3,960	6,670	4,770	353	6,800	16,900	32,400
1958	2,860	523	18,900	560	3,410	10,100	16,300	9,900	1,260	15,600	26,100	51,000
1959	954	172	10,600	184	1,210	3,540	5,790	3,830	250	5,570	27,500	53,800
1960	4,800	881	32,700	944	6,740	20,200	32,400	18,300	2,760	30,000	91,700	180,000
1961	115	20	5,790	21	911	2,670	4,380	5,180	475	7,650	12,900	24,600
1962	3,100	566	19,300	607	4,100	12,000	20,000	12,300	1,720	20,000	41,000	79,600
1963	5,450	999	39,800	1,070	9,710	30,000	47,900	10,700	1,250	17,000	42,500	82,800
1964	977	178	10,200	191	1,470	4,330	7,460	5,800	599	8,800	18,600	35,800
1965	1,350	247	13,600	265	2,960	5,890	10,200	9,840	1,330	15,800	29,900	57,200
1966	1,800	330	16,400	354	2,630	7,710	12,900	7,260	845	11,300	22,200	42,900
1967	7,790	1,420	42,100	1,530	7,050	19,100	32,000	19,400	2,970	32,500	82,500	162,000
1968	3,470	634	25,600	679	4,410	12,700	20,900	10,400	1,400	15,400	41,500	80,500
1969	10,400	1,910	50,000	2,040	9,510	25,800	43,000	21,300	3,250	34,900	118,000	231,000
1970	4,160	761	27,800	815	5,030	14,600	25,100	15,200	2,210	25,200	55,500	107,000
1971	1,990	363	14,200	389	2,320	6,680	11,200	12,900	1,830	21,200	27,200	51,300
1972	3,190	583	25,500	624	5,350	16,300	27,700	16,100	2,180	26,600	52,600	99,400
1973	859	155	10,100	167	1,140	3,140	6,590	4,010	274	6,100	15,300	27,300
1974	8,200	1,501	44,200	1,610	9,640	26,900	44,600	24,600	3,810	41,100	101,000	196,000
Minimum	115	20	4,740	21	686	2,340	1,740	2,640	82	3,630	6,930	14,400
Maximum	20,300	3,720	91,200	3,980	16,600	43,900	72,400	46,800	5,020	67,300	177,000	331,000
Mean	3,840	647	24,640	705	4,920	13,000	21,400	12,700	1,570	19,200	47,500	92,600

* Synthesized flows as explained in letter location which had some recorded data although not necessarily for the complete period of record

VII. [illegible]

The probable future [illegible] trends plans to use water in the [illegible] to 1985 and to provide some [illegible] after 1985. The intent of [illegible] for evaluating the impact of [illegible] streamflow on potential water [illegible].

The Poplar River Water [illegible] drainage systems in the region. In the [illegible] potential water uses to greatly [illegible]. Therefore, it is necessary to view [illegible] projects within the context of available water [illegible].

[illegible]

Two levels of future water [illegible] t increase water use in the basin [illegible] possible future use beyond the [illegible] identified under five categories [illegible]:

1. Domestic [illegible]
   - by [illegible]
   the [illegible]
   [illegible]
2. Irrigation [illegible]
   [illegible]
   [illegible]
   [illegible]
   [illegible]
   [illegible]
   [illegible]
   [illegible]
   [illegible]

3. Municipal Use

   - by projecting the requirements of municipalities in the watershed which draw water from wells located adjacent to river courses in the basin.

4. Industrial Uses

   - by estimating the water requirements of industrial development in the basin that are presently proposed or represent future potential. In Saskatchewan, these potential demands are related to development of lignite coal deposits. Construction of a reservoir on the East Poplar River near Coronach is presently underway to supply water to a coal-fired thermal power plant. In Montana, a potential use for water has been identified related to potash mining near Scobey.

5. Wildlife Use

   - some potential exists for wildlife impoundments which may be constructed prior to 1985.

A detailed description of the studies carried out in Montana and Saskatchewan to evaluate these future water use demands is presented in Appendix C.

Results

Future water uses that have been identified in the Poplar River Basin in both Montana and Saskatchewan are summarized in Table 7. These estimates of future water use may not be totally indicative of the development potential in the basin as they have been based on available resource data. Future resource surveys may therefore affect these estimates. Furthermore, these potential uses exceed the available local runoff in many years, a factor which will act to limit future development.

Table 7a: Identified [illegible]
Basin in [illegible]

Type of Use	Use Intended by 198[illegible]	[illegible] Future [illegible]
Domestic	18	
Irrigation	271	
Municipal	136	
Industrial	10,238	8[illegible]
Wildlife	370	
TOTAL	11,163	8[illegible]

Table 7b: Identified future water [illegible]
Basin in Acre-Feet

Type of Use	Use Intended by 198[illegible]	[illegible] Future [illegible]
Domestic	13[illegible]	
Irrigation	[illegible]	[illegible]
Municipal	[illegible]	[illegible]
Industrial	[illegible]	
Wildlife	[illegible]	
TOTAL	[illegible]	[illegible]

VIII. FLOW APPORTIONMENT AND ADMINISTRATION

Various apportionment alternatives were examined by the Task Force during the course of this study. These alternatives encompassed various percentage splits of streamflow on the tributaries and streams in the Poplar River Basin at the international boundary. Also, continuous minimum flows and short term volume releases in varying quantities were considered on the East Poplar River. The storage reservoir near Coronach, which is presently under construction, will facilitate this form of water delivery to the United States on the East Poplar. After these apportionment schemes were proposed, they were examined to determine their effect on both existing and future water uses in the basin. Desired modifications to these alternatives produced new apportionment alternatives during this formulation process until the Canadian and United States sections of the Task Force determined a mutually acceptable method of dividing the flows of the Poplar River.

Apportionment Recommendations

The Poplar River Task Force unanimously recommends that the waters of the Poplar River and its tributaries should be apportioned on the following basis:

A. The aggregate natural flow of all streams and tributaries in the Poplar River Basin crossing the international boundary shall be divided equally between Canada and the United States subject to the following conditions:

1. The total natural flow of the West Fork Poplar River and all its tributaries crossing the international boundary shall be divided equally between Canada and the United States but the flow at the international boundary in each tributary shall not be depleted by more than 60 percent of its natural flow.

of 0.028 cubic metres per second (1.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 617 cubic decametres (500 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

iii) When the total natural flow of the Middle Fork Poplar River, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period is greater than 9,250 cubic decametres (7,500 acre-feet), but does not exceed 14,800 cubic decametres (12,000 acre-feet), then a continuous minimum flow of 0.085 cubic metres per second (3.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary during the succeeding period June 1st through August 31st. A minimum delivery of 0.057 cubic metres per second (2.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 617 cubic decametres (500 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

iv) When the total natural flow of the Middle Fork Poplar, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period exceeds 14,800 cubic decametres (12,000 acre-feet) then a continuous minimum flow of 0.085 cubic metres per second (3.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary during the succeeding period June 1st through August 31st. A minimum delivery of 0.057 cubic metres per second (2.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 1,230 cubic decametres (1,000 acre-feet) shall be delivered to the United States upon demand at

[illegible]

5. The natural [illegible]
purposes shall be [illegible],
for periods of time [illegible]
of both countries.

Administration [illegible]

The Poplar River [illegible]
of Control be appointed by the [illegible]
the apportionment agreement under the [illegible]
the following terms of reference and [illegible]

Poplar River [illegible]

Membership

The membership of the Board [illegible]
two representatives from each country [illegible]
and the United States respectively [illegible]
nominated by the Government of the [illegible]
Saskatchewan respectively. [illegible]
joint commission from each country [illegible]
meetings held in his country. [illegible]
Poplar River will be [illegible]
Government [illegible]

Meetings

[illegible]

Reports

[illegible]
natural [illegible]

the water division computations and estimates, describe any problems which have arisen and make recommendations on matters outside the delegated responsibilities of the Board of Control.

Network Design and Computation Methods

The Board of Control will be responsible for the design of the stream gauging and other monitoring networks including location, frequency of observation and standards necessary to carry out the division of the water under the terms of the apportionment agreement. It will also be responsible for determining when and where indirect methods of calculating depletions and runoff are sufficient.

Division Periods for Water Deliveries

The Board of Control will be responsible for determining division periods for natural flow computations when it becomes necessary to divide the waters of the streams and tributaries crossing the international boundary because of increasing levels of depletion in the upstream country.

Schedule for Water Deliveries on East Poplar River

The Board of Control shall determine the rules and procedures to be used in meeting the requirements for the volumetric releases to the United States on the East Poplar River. Consideration shall include minimum notification for the release, scheduling, monitoring and liaison contacts.

Disagreements

In the event of disagreement between the two sections of the Poplar River Board of Control, the matters in controversy shall be referred to the International Joint Commission for decision.

Other Considerations

Monitoring Agencies

The Poplar River Task Force further recommends that the monitoring agencies be the Water Resources Division, United States Geological Survey, Department of the Interior and the Water Survey of Canada, Environment Canada.

Data Collection

First class stream flow [illegible] designed specifically to provide [illegible] flow ranges, be constructed on the [illegible] boundary and the Middle Fork Poplar [illegible]

A continous record of flow [illegible] River at the international boundary [illegible] continuous record of flows will also be maintained [illegible] River below the confluence with Goose Creek [illegible] as the derivation of natural flows for this period [illegible] water delivery to the United States on the East Poplar.

Methods of Calculation

The method of computation of natural flows [illegible] some extent by the level of depletion in the basin [illegible] monitoring requirements and computational effort. [illegible] should be periodically reviewed by the Poplar River [illegible] altered when required for efficient administration [illegible] agreement. General concepts that should be adopted [illegible] are listed below:

1. The natural flow at the international [illegible] or stream will be determined by [illegible] to the recorded or estimated flow at the [illegible]

2. Water use in those portions [illegible] streamflow crossing the international [illegible] once in two years will be [illegible] computation of the natural flows.

3. Depletion [illegible] determination of natural flows [illegible] that does not exceed [illegible] any stream or tributary [illegible]

4. Indirect estimating procedures will be used to determine the flow in tributaries or streams crossing the international boundary where depletions in the upstream country are significantly less than the limits specified in the apportionment agreement.

Impact [illegible]

The proposed apportionment [illegible] the availability and the distribution [illegible] United States. The intent is to allow [illegible] resources in both countries so that [illegible] what portion of the natural flow can be [illegible]

Requirements of the two countries [illegible] recommendations on individual streams. A [illegible] East Poplar River where under natural conditions [illegible] boundary occasionally dropped to zero. [illegible] is made for releases on demand each year to [illegible] Canada, in turn, will have the right to [illegible] flows on the East Poplar River for future [illegible]

The numerical effect of the [illegible] Table 8 for two conditions. The first condition [illegible] Canada's present level of development. [illegible] flow that would occur with one 300 megawatt [illegible] the proposed Saskatchewan Power Corporation [illegible] near Coronach and the existing level [illegible]

Discussion of the proposed [illegible] without some mention of the [illegible] in the Poplar River [illegible] Poplar, the interstate [illegible] Poplar River near [illegible] the Middle [illegible] for representative [illegible] initially two coal-fired [illegible] megawatt unit would be [illegible]

Table 8: The Impact of Canadian Diversions on Poplar River Annual Flows

	Mean Flow Year		Maximum Flow Year		Minimum Flow Year	
	dam³ (acre-ft)	% of Natural Flow	dam³ (acre-ft)	% of Natural Flow	dam³ (acre-ft)	% of Natural Flow
Present Level of Canadian Use						
East Poplar @ Int'l Boundary	14,200 (11,500)	92.1	56,900 (46,100)	98.6	2,330 (1,890)	71.5
Middle Fork @ Int'l Boundary	15,800 (12,800)	98.6	54,000 (43,800)	99.6	2,670 (2,160)	92.3
West Fork @ Int'l Boundary	4,400 (3,560)	93.8	24,700 (20,100)	99.0	73 (59)	51.3
Poplar R. nr. Scobey	48,800 (39,600)	97.6	171,000 (139,000)	99.3	7,950 (6,440)	87.4
Poplar R. nr. Poplar	112,000 (91,100)	98.4	409,000 (332,000)	99.6	16,400 (13,300)	92.1
Assuming Present Canadian Use Plus the East Poplar Reservoir near Coronach with One 300 MW Unit						
East Poplar @ Int'l Boundary	7,620 (6,170)	49.5	52,700 (42,700)	91.3	1,260 (1,020)	38.7
Middle Fork @ Int'l Boundary	15,800 (12,800)	98.6	54,000 (43,800)	99.6	2,670 (2,160)	92.3
West Fork @ Int'l Boundary	4,400 (3,560)	93.8	24,700 (20,100)	99.0	73 (59)	51.3
Poplar R. nr. Scobey	42,300 (34,300)	84.4	166,000 (135,000)	96.4	6,870 (5,300)	75.6
Poplar R. nr. Poplar	106,000 (85,800)	92.7	404,000 (328,000)	98.4	15,300 (12,400)	86.1
Spillage from East Poplar Reservoir with One Unit (Spill in 16 Years)						
	4,320 (4,310)	34.3	39,800 (32,300)	69.0	0	0

Interim Apportionment

The Canada-United States bilateral meeting held in April 1975 requested the Governments of Saskatchewan and Montana to discuss and develop recommendations for apportionment of East Poplar River waters during the filling period of the Saskatchewan Power Corporation reservoir on the East Poplar River near Coronach, Saskatchewan. It is the view of the Task Force that the immediate implementation of the recommended long-term apportionment would decrease the probability of filling that reservoir to the required operating level (elevation 749.0 m or 2,457 ft.) by 1979. The Task Force recommends that consideration be given to interim apportionment during the filling period of the East Poplar Reservoir near Coronach.

Water Quality

Water Quality was discussed at the Canada-United States bilateral meeting in April, 1975. Agreement has been reached on a monitoring program which will provide needed information on existing water quality and on any changes that may occur as a result of changes in flow regime, reservoir control, and development. The Task Force was informed of the commitments of the Government of Saskatchewan and the Saskatchewan Power Corporation pursuant to the licence issued by the Minister of Environment, Government of Canada under the International River Improvements Act. Water quality was a consideration in framing the recommendations of the Task Force on minimum flow requirements on the East Poplar River at the international boundary. However, during the course of the studies it has become apparent that water quality impacts of apportionment of the waters in the Poplar River Basin require assessment. The apportionment will allow substantial use and reduction of the flow of the East Poplar River. The water quality effects of a change in the flow regime are unknown. The Task Force recommends that consideration continue to be given to the water quality implications of the proposed apportionment.

The United States section of the Task Force recommends several [illegible] should be undertaken to the mutual benefit of both countries. In general these studies should be directed toward analyzing the effects [illegible] flow regime, reservoir control and planned large-scale [illegible] listed on the following page:

c) [illegible]

b) [illegible]

) Future expansi[illegible]
importation of water [illegible]
of the Poplar River [illegible]
be included in the f[illegible].

the Canadian Secti[illegible]. The latter of water quality i[illegible] data collection was initiated in 197[illegible] has been approved. Additional studie[illegible] data base is available. The Canadia[illegible] state specifically what studies or [illegible].